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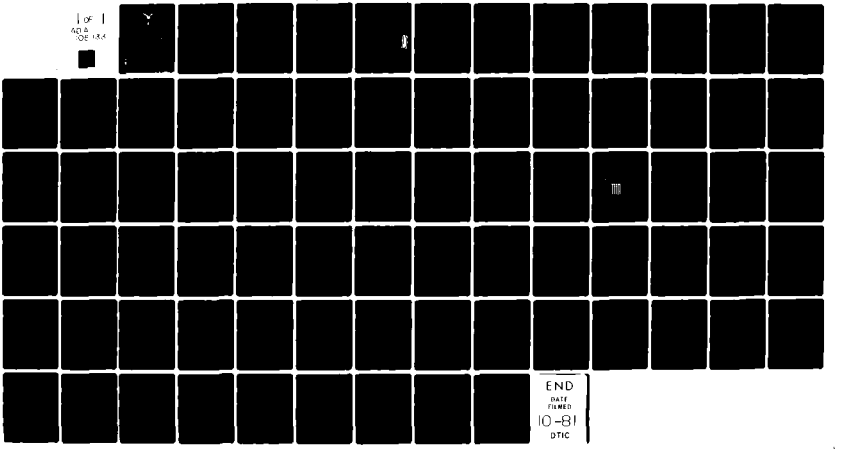

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Wright-Patterson Air Force Base, Ohio

EVALUATION CRITERIA FOR THE USE OF MATRIX CONCEPTS WITHIN THE AIR FORCE

Monty D. Bongarts, Captain, USAF
Marilyn M. Taylor, Captain, USAF

LSSR 36-81

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The matrix concept of management began in the aerospace industries where large projects required a divergent management approach to insure adequate command and control. Federal Government insistence upon exact project costs, timely information relative to particular programs, and stringent time schedules forced industries into the matrix form. The matrix overlays the functional structure with a permanent project structure and the distinguishing feature of its design is the sharing of personnel resources. Limited matrix managements concepts have been employed in the Air Force since the early 1960s. In 1976 the Aeronautical Systems Division of the Air Force Systems Command formally converted its entire organizational structure to a matrix system. Today's Air Force becomes increasingly complex as it keeps abreast of rapidly changing technologies. The military manager recognizes that diminishing available resources, both materiel and human, dictate that the most efficient use must be made of these resources. To ignore the matrix concept of management at any level may be to deprive the Air Force of a more efficient managerial technique. The authors felt that the decision to adopt a matrix form or any of its techniques is a decision that must be made by the organization itself.

LSSR 36-81

EVALUATION CRITERIA FOR THE USE OF MATRIX CONCEPTS WITHIN THE AIR FORCE

A Thesis

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Logistics Management

By

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This thesis, written by

Captain Monty D. Bongarts

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Captain Marilyn M. Taylor

has been accepted by the undersigned on behalf of the faculty of the School of Systems and Logistics in partial fulfillment of the requirements for the degree of

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COMMITTEE CHAIRMAN

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CHAPTER I

INTRODUCTION

> For generations, managers lived with the happy fiction of dotted lines, indicating that a second line was necessary if not formal. The result had always been a sort of menage à trois, a triangular arrangement where the manager had one legitimate relationship (the reporting line) and one that existed but was not granted equal privileges (the dotted line). As executives develop greater confidence with the matrix form, they bring the dotted line relationship out of the closet, and grant it legitimacy [2:21].

The name matrix management began to appear in the business realm during the 1950s and 1960s. It described a structure which already existed in various organizations by other names: specifically program or project management. Its beginnings, as a formally recognized form of management, were primarily in the aerospace industries where large projects required a divergent management approach to insure adequate command and control. These industries were more or less forced into the matrix form as a result of Federal Government insistence upon exact project costs, timely information relative to particular programs, and stringent time schedules. Their prior management practices were unable to provide this vital data because the data was not available on a project-by-project basis.

In the 1960s and 1970s the technique spread through such diversified commercial corporations as Dow Chemical,

General Electric, and Texas Instruments. These firms had divisionalized, regionalized, and diversified to such an extent their functionally designed corporate structures were unwieldy and saturated with blockages in the executive hierarchy.

The concept received a mixed welcome throughout the business world for a variety of reasons. The matrix structure is inherently complex in that it simultaneously incorporates both functional and project management concepts which have made it a difficult technique for managers and employees to fathom. Employees often failed to adapt to the cross-functional reporting while management often neglected to clearly define responsibilities and reporting lines. Some companies adopted the matrix approach, found it worked well, and continued refining their structures, internal procedures, and definitions until they were comfortable with the matrix operation. Other business concerns found the technique much too cumbersome to control and eventually reverted to their former management practices, although they might have been inadequate. Many companies felt it was such a radical departure from traditional methods, functional and project structures, they refused to even consider adopting matrix management.

> If the matrix organisation is a comparatively new development it is because the situations that have called it into being are themselves new: larger organisations with more complex inter-dependencies, tasks, techniques, and knowledge changing faster than ever before and a changing social context [6:2].

The matrix concept has been thought of as an innovative approach to management. It is in fact a permanent extension of the more familiar project management practice. A derivation of the matrix management concept is presented in detail in Chapter III of this study. Norman H. Wright, Jr., a planning administrator at Martin Marietta Aerospace, Orlando Division, has defined matrix management as ". . . an integrative management technique for sharing a common pool of specialists on a time-shared basis across the various product lines or projects [17:58]." This definition implies a criss-crossing of the functional or "vertical" forces with the project or "horizontal" groups. Figure 1-1 illustrates the matrix structure. The horizontal component of the matrix is viewed by the vertical component ". . . as a group of colleagues able to short-circuit official channels to get together, pool their knowledge and get on with the job at hand [6:4]."

> It is obvious to anyone who has worked in even the most stringent hierarchy, or bureaucracy, that any organisation is really a matrix or mixed model with multiple-channel communication [5:5].

What actually distinguishes matrix management from the more traditional project and functional forms is the sharing of personnel resources. A dual chain of command exists in that some personnel report to two bosses of approximately equal import. This facet of the matrix is

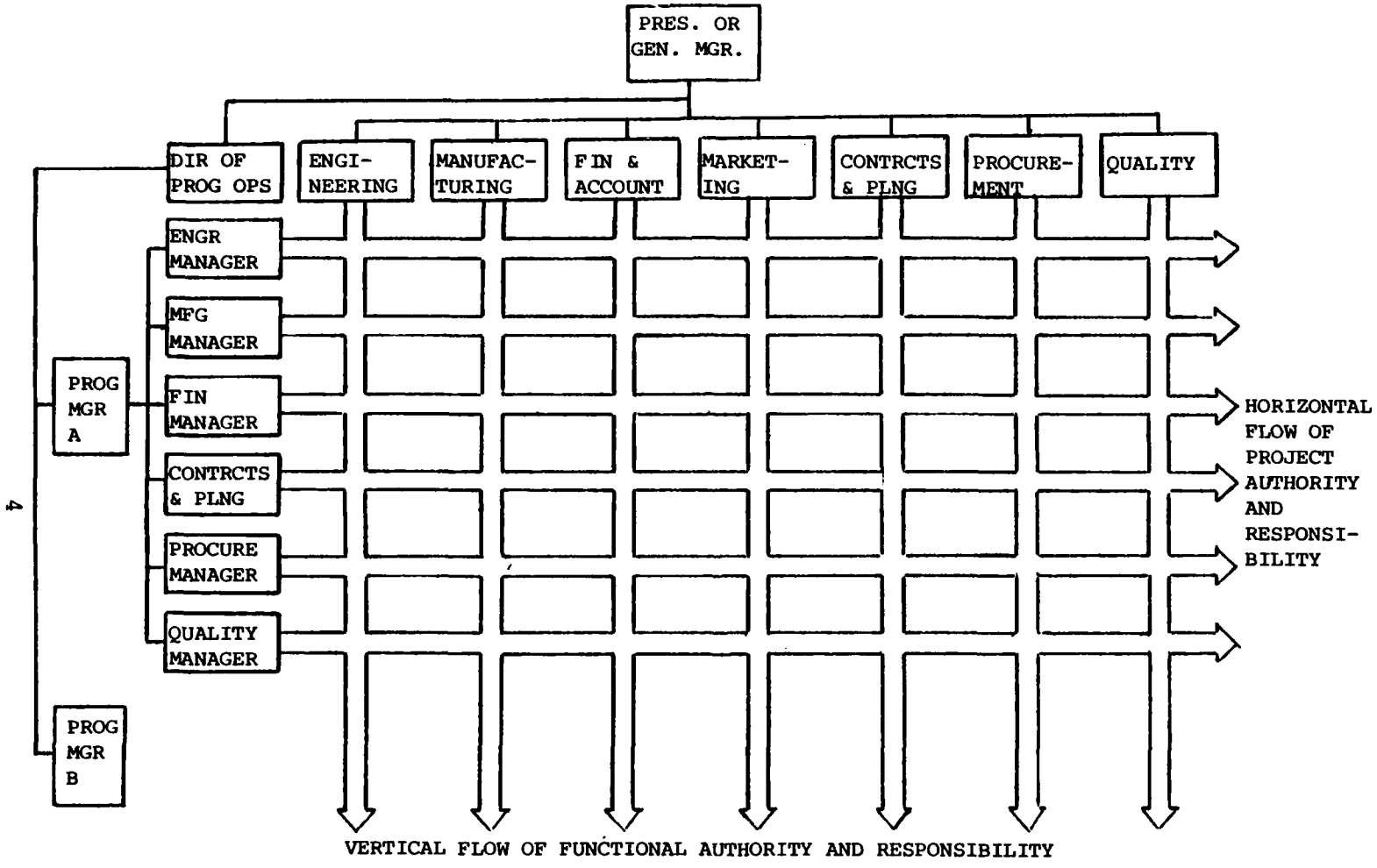


Fig. 1-1. Matrix Organizational Structure (17:60)

perhaps the most controversial and misapplied of the entire system.

Considerable research has been documented about the theory and application of matrix management in the Air Force Systems Command's (AFSC) product divisions. One of the more recent and most thorough studies was conducted by Major Karl T. Thurber, USAF in 1978 (15). Limited matrix management concepts have been employed since the 1960s in the Aeronautical Systems Division (ASD) of AFSC at Wright-Patterson AFB, Ohio. However, it was not until 1976 that the entire ASD organizational management structure was formally converted to a matrix system. In addition, the other AFSC product divisions are moving toward more matrixing as a means of accomplishing their missions more efficiently. To date, very little focus has been directed toward the use of this structure within the smaller, more functionally oriented Air Force base level support organizations. Will the matrix concept be regarded as a technique applicable only to a select few Air Force organizations or can it be employed at levels of the Air Force structure lower than the AFSC product divisions?

Problem Statement

The matrix concept of management has been implemented and refined within AFSC project divisions, the Air Force Logistics Management Center (AFLMC) at Gunter Air

Force Station, AL, and in several civilian corporations to cut costs and gain better operational control. Will organizational objectives allow Air Force base level organizations, not presently employing any matrix management form, to formalize their structure upon matrix lines?

Objectives of the Research

The objectives of this study are:

1. Trace the evolution of matrix with its inherent strengths and weaknesses.

2. Develop matrix management evaluation criteria that will enable the organizational decision makers to analyze their present structure to determine if matrix management would enhance mission accomplishment.

Justification for Research

The military manager recognizes that in these times of diminishing available resources, both materiel and human, the most efficient use must be made of these resources. Although a highly complex managerial technique, matrix structuring has been found to be extremely effective within a variety of large corporations. Today's Air Force becomes more complex as it keeps abreast of rapidly changing technologies. It is imperative that all management concepts be considered to adequately meet Air Force mission needs. To ignore the matrix concept at lower levels of the Air

Force structure may be to deprive ourselves of a more efficient managerial technique (15:2-3).

Hypothesis

Matrix management concepts and techniques at the Air Force base level structure are both applicable and desirable.

CHAPTER II

RESEARCH METHODOLOGY

This study has lent itself to two distinctive research designs: exploratory and case. The exploratory design was chosen because of its flexibility and the limited applicable data on the study topic. By definition exploratory research is ill-structured and much less focused on predetermined objectives, but its flexibility overrides these weaknesses. The purpose for this research design was to develop hypotheses for testing and/or investigative questions for the research. Typically this design is most interested in getting information from those sources that might prove especially "insight-stimulating." Through exploration, the concepts were developed more clearly and in many ways improved the final research design.

The second design employed was a case study approach. During this segment of the study, further research was conducted at the 2046th Communication and Installation Group (CIG) and 2750th Civil Engineering Squadron (CES) at Wright-Patterson Air Force Base, Ohio.

Although an extensive literature review was accomplished before outside contacts were approached, it

remained necessary to continue this phase of research throughout the study. As previously stated, matrix management is a relatively new concept; therefore, the data bank continues to increase. Chapters I and III were structured to give the reader an understanding of matrix management, but for means of clarification and interest stimulation, additional background information has been inserted throughout.

Scope of the Organizational Review

This portion of the study involved the Air Force Logistics Management Center (AFLMC) at Gunter Air Force Station, Alabama, the Aeronautical Systems Division (ASD) of Air Force Systems Command (AFSC), the 2046th Communications and Installation Group (CIG), and the 2750th Civil Engineering Squadron (CES) at Wright-Patterson Air Force Base, Ohio. The AFLMC and ASD have implemented a matrix management concept. Our review of existing data and telephone contacts with these two organizations revealed a number of investigative leads that may have gone unheeded because they were previously not observable or because they were uninteresting to prior researchers. With these leads and previously acquired information, we placed emphasis on a subjective study of the Installation Deputate (ID) of the 2046th CIG and the Operations Maintenance Branch (MEM) of the 2750th CES.

Data Collection

With matrix management being a relatively new field of endeavor, we needed to learn more about the subject and to determine if it was practical to attempt a study. As is quite often the case, the literature review narrowed the focus of our investigative research and allowed us to define the scope of the topic.

A one-on-one relationship between interviewer and interviewee (personal mode interview) was used. Initial interviews were conducted with an interview guide used merely as a prompter during the interview. Questions were loosely structured to allow respondents to present opinions, feelings, and attitudes. If the respondents made inquiries as to the specific meaning of a particular question, the intent of the question was explained. Final interviews were accomplished using evaluation criteria with structured questions developed from research and initial interviews.

CHAPTER III

THE EVOLUTION OF MATRIX MANAGEMENT

The highly flexible, customer responsive matrix structure did not appear on the horizon as a totally new approach to management organization. Rather, it evolved from the more traditional functional structure with a significant portion of its design derived from the project management form. It will be helpful at this point to examine these two more familiar organizational management forms, functional and project, to understand the necessity for their merger into the so-called matrix form.

Functional (Classical) Organization

Francis L. Siau III, USAF, in paraphrasing R. A. Killian stated: "A company is never formed simply to establish an organization; rather the organization emerges as a process for accomplishing the company's purpose [14:9]." Most organizations began as small, intimate structures with few communication, coordination, or labor division problems. As these organizations grew in size, internal responsibilities and effective communication became increasingly difficult to control. Functional structuring emerged and dominated the business realm as a means of controlling organizations.

The functional organizational structure is still the most prevalent form. It is easily understood, works relatively well, and is one of the better means of coping effectively with small scale complexity. This form is pictorially shaped somewhat like a pyramid. The overall manager is at the apex of the structure followed by the major functional department heads; i.e., production, procurement, engineering, sales, et cetera. Further divisions within the departments continue the pyramidal outline to its base (see Figure 3-1).

The basis of this organizational structure is that:

1. There is work specialization divided into departments.

2. There is span of management control with no one supervising in excess of six subordinates.

3. There is unity of command, which means no one reports to more than one supervisor.

4. There is a clear delineation of the chain of command with responsible authority delegation (13:192).

Departmentation groups individuals by occupation. Production specialists are in the production department, sales personnel are in the sales function, and so forth throughout the organization. Each department head is concerned with only one area of the organization and can thereby devote his entire energy to the improvement of that area. The manager can make maximum use of the

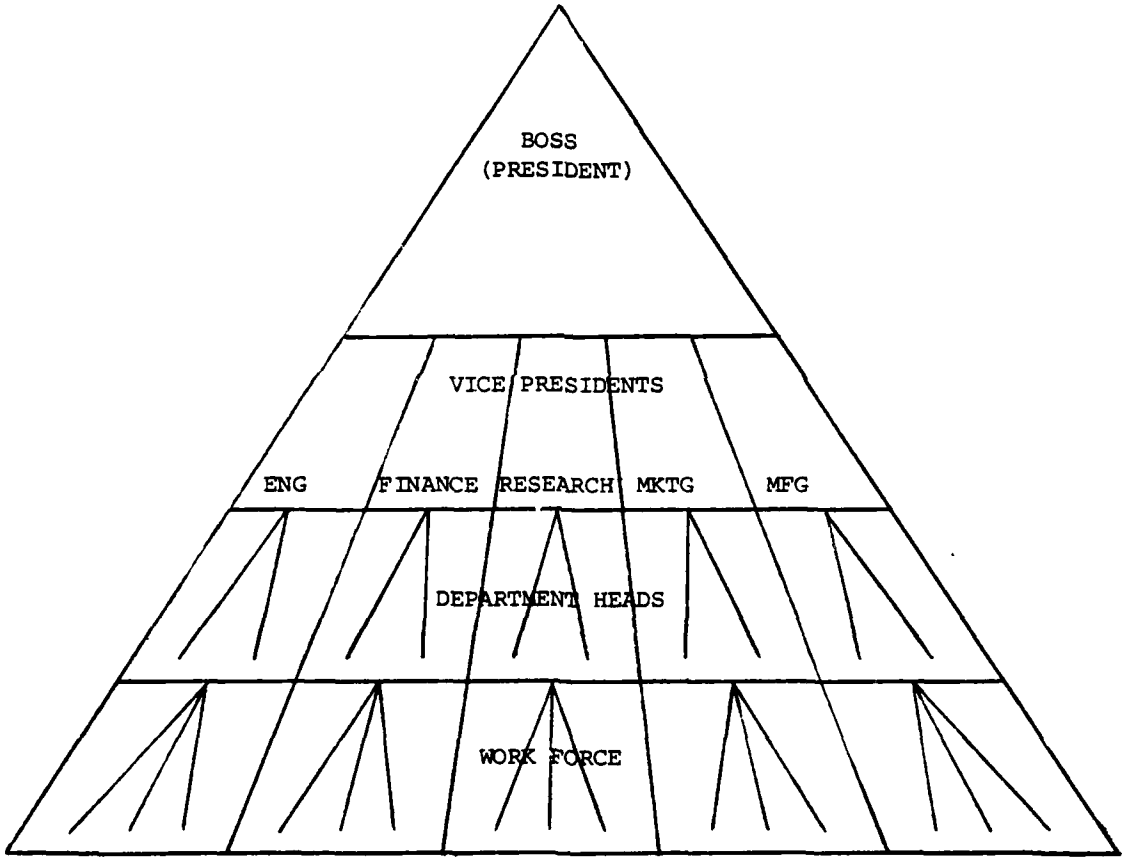


Fig. 3-1. Functional Structure

available resources within the department and can readily shift personnel and other resources to even workloads.

One manager supervising all of one type of work activity facilitates interdepartmental coordination and communication. Decisions that cross department (functional) lines are forced to top management levels eliminating intradepartmental strife at lower levels.

This traditional hierarchial organizational structure works well for firms with limited or well defined product lines. But, as a company grows, the centralization of decisions causes delays in the flow. Bottlenecks are inherent as everything, by virtue of organizational design, must pass through the department heads thus causing extended time lags in the decision-making process.

Ross and Murdick raise several criticisms of the functional form (13:193):

1. It is too mechanistic and ignores major facets of human nature.
2. It is too structured to adapt to change.
3. Its formal directives and procedures hinder communications.
4. It inhibits innovation.
5. It pays the job not the man.
6. It relies on coercion to maintain control.
7. Its job defensive behavior encourages make-work.
8. Its goals are incompatible with its members.
9. It is simply out of date with the need of the Seventies.

Effective control of an organization functionally designed becomes increasingly difficult as its size increases. It is virtually impossible to differentiate the

cost of any single product. As managers move up the chain to top level positions they either retain departmental biases or must struggle to learn the other various facets of the business. Even their viewpoints may remain slanted to the particular area of specialization with which they are familiar. Behavioralists propose that the functional structure be modified to provide (13:194):

1. A more democratic attitude on the part of managers.
2. More participation in major decisions at lower levels.
3. Decentralization of decision making as far as possible.
4. Less emphasis of hierarchy and authority delegation.
5. Less narrow specialization of work tasks.

But even adoption of these proposals will not cure the ills of a corporation that has ceased efficient operation within its structural constraints. The management must look at alternative structural forms to enhance operations. One of the most common forms of structure to which management turns is the product or project form.

Project (Product) Organization

Project or product (herein used interchangeably) departmentation is the grouping of work based on the nature of the product or service to be provided. It is used by a firm when the functional design no longer provides the necessary degree of coordination between functions. Project organization incorporates cross-functionalization in that each project has its own production, engineering,

sales, procurement, and other personnel necessary for project accomplishment.

The project management concept evolved during World War II in both the military and industrial establishments. It was conceived to effectively control the development of new, larger than ever weapons systems/products. As Middleton states: "a project organization is responsible for completing an assigned objective on schedule, within cost and profit goals and to established standards [9:19]." Rolefson expands this definition by saying it "is the application of planning, organization, coordination and control concepts and techniques to critical, complex, one-of-a-kind jobs. It is a specialized management form [12:278]." Typically, upon completion of the project, personnel were returned to their functional specialties. Figure 3-2 illustrates the project structure.

Many corporations adopted a wide scale product structure when the functional structure became too unwieldy. Product alignment afforded the corporations several advantages: they were able to control individual projects better; they could develop better customer relations; they could reduce product development time with dedicated personnel; they could improve product quality and reliability; and they could experience expirit de corps within individual projects.

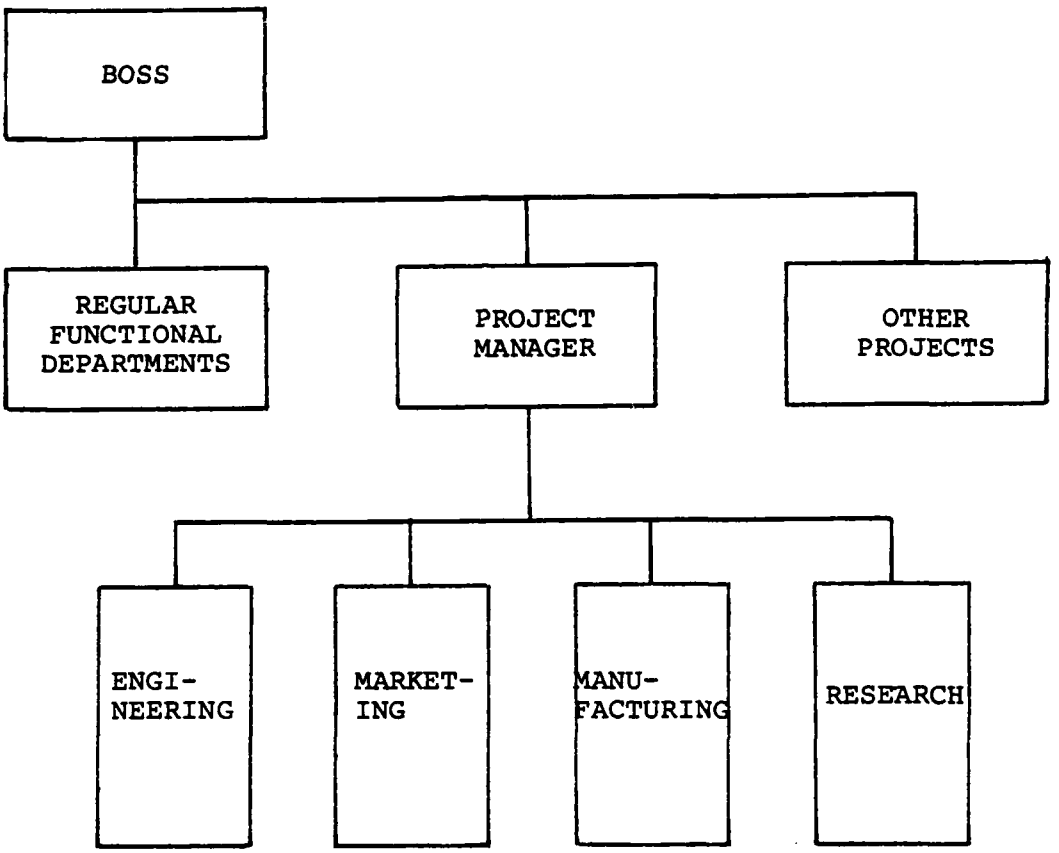


Fig. 3-2. Project Organization (18:47)

Flexibility with the project form was available to industry. Throughout any one project's life it might pass through several stages--individual, staff, intermix, or aggregate. The individual organization is composed solely of the project manager. In a staff organization, the project manager is provided a control staff with functional departments still performing engineering, procurement, and manufacturing. When some of the functional tasks are assigned directly to the project manager an intermix organization exists. An aggregate project organization exists when all company resources required to accomplish a project are assigned to the project manager (9:21).

As with any managerial form, project management has its disadvantages. One of the most significant criticisms has been the effect on employee morale. Due to the short-term nature of projects, employees tend to be concerned with career progression and loss of their "home" within the functional structure while assigned to a project.

Another major disadvantage is the expensive duplication of facilities and inefficient use of resources. This very often offsets the monetary advantages of product organization. As Patterson discovered, "'We had six of everything. We had to operate at 92 percent capacity just to break even' [10:10]." Additionally, project managers denied functional units the lessons learned from projects

by retaining the best and most experienced personnel within the project organizations.

Although some corporations alleviated some of these disadvantages by permanent organization constructed on product lines, such as the major U.S. automakers or the aerospace industries, a new organizational structure was essential to cope with the complexities of size and a continually increasing technological base. The matrix organizational form was born out of this need to cope with the complexities that face us today.

The Matrix Structure

The need for a better management technique/organizational structure became apparent to the federal government and to industry during the late 1950s and early 1960s. Rapid growth, changing economic and market conditions, and high technological development made it imperative for the business realm to keep pace. The traditional functional organization was unable to respond rapidly to these factors. The project organization was just too costly in terms of duplicative facilities and wasted resources. Both forms had their merits, however, and the matrix structure evolved to merge them as an organizational design structure.

Matrix structure is a hybrid of the project and functional types of organization. David and Lawrence

define it "as any organization that employs a multiple command system . . . [1:3]." Drake further elaborated when he said, "the system pushes decision making downward, puts a premium on teamwork, and provides maximum flexibility and productivity [3:4]." Youker has called the matrix "a multidimensional structure that tries to maximize the strengths and minimize the weaknesses of both the project and functional structures [18:48]." All of these definitions are correct, but a more descriptive definition was needed.

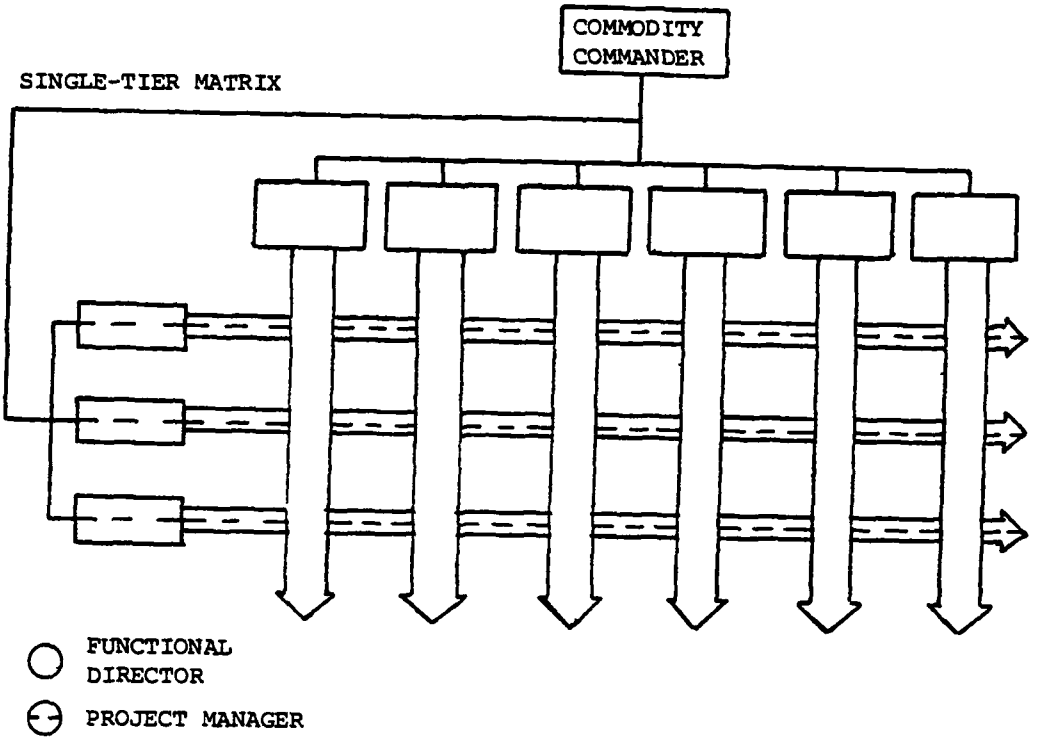
In our opinion, Wright has most clearly defined the matrix management form. "It is an integrative management technique for sharing a common pool of specialists on a time-shared basis across the various product lines or projects [17:58]." This sharing of personnel resources across functional boundaries is the distinguishing feature of the matrix form.

The matrix form of management has a definitive life cycle; definitive in terms of phases of development not time frames. The first three phases of development include its inception, its development as a temporary form of management within the organization, and its emergence as a permanent structure. The final two phases of the matrix life cycle are the fully operational (mature) matrix and the organization's emergence from the matrix into another form (1:37-46).

Within a mature matrix, the organizational structure may be classed as simple, two-tiered, or multi-dimensional. Initially, all matrix structures are simply aligned (see Figure 3-3). The functional component (vertical) is present with project (horizontal) overlapping creating an atmosphere of dual authority. Within the simple matrix, the project overlay is organized on functional lines. That is, the project is subdivided into functional areas.

The two-tier matrix differs only slightly from the simple matrix. The project overlay employs a matrix design within its boundaries. The alignment of this structure is similar to the one used by the organization as a whole (see Figure 3-4). This internal subproject focus "assists the project manager in his role as program integrator [16:41]." Two-tiered matrices add flexibility, constructivity, and versatility to the conventional matrix structure (see Figure 3-5).

The multidimensional matrix is employed by a very limited number of organizations. These organizations have grown from simple matrix through two-tiered matrix to three and four matrix overlays with simultaneous chains of command. Texas Instruments has evolved to a three-dimensional structure with a product structure matrixed against a functional structure and the third dimension a time-oriented structure. Dow Corning has gone one step further



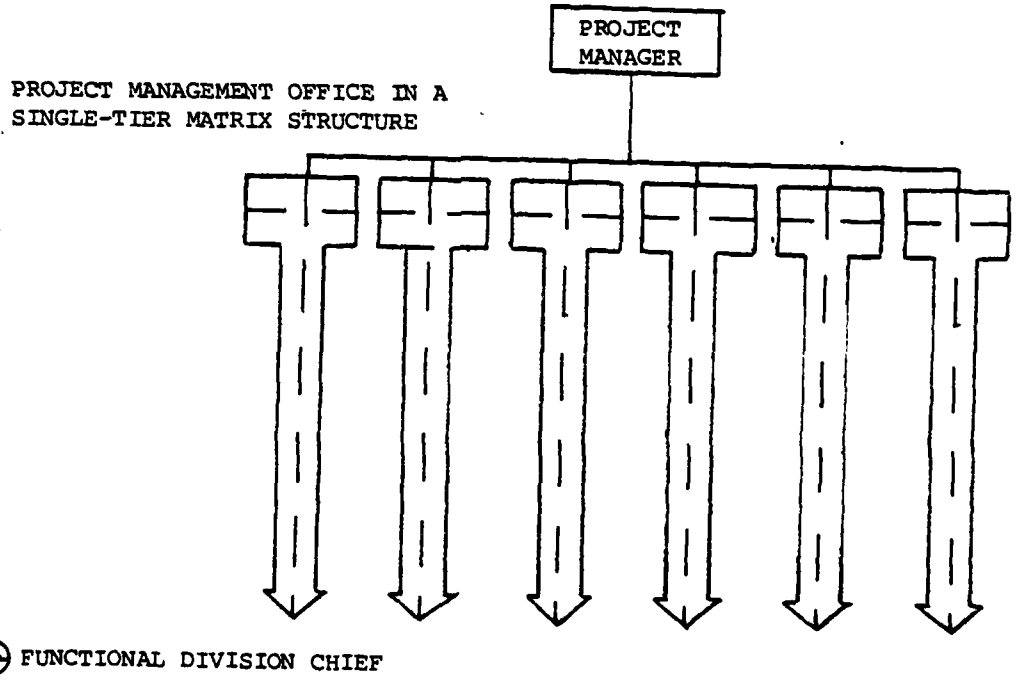
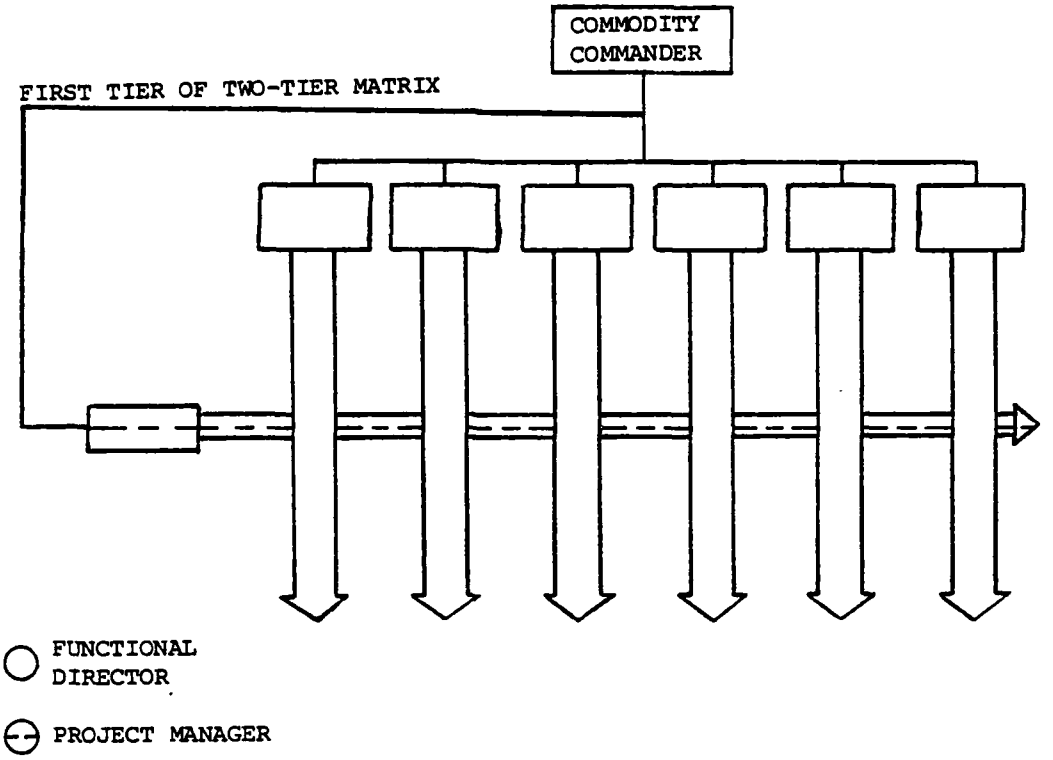


Fig. 3-3. The Simple Matrix Organization (16:39)



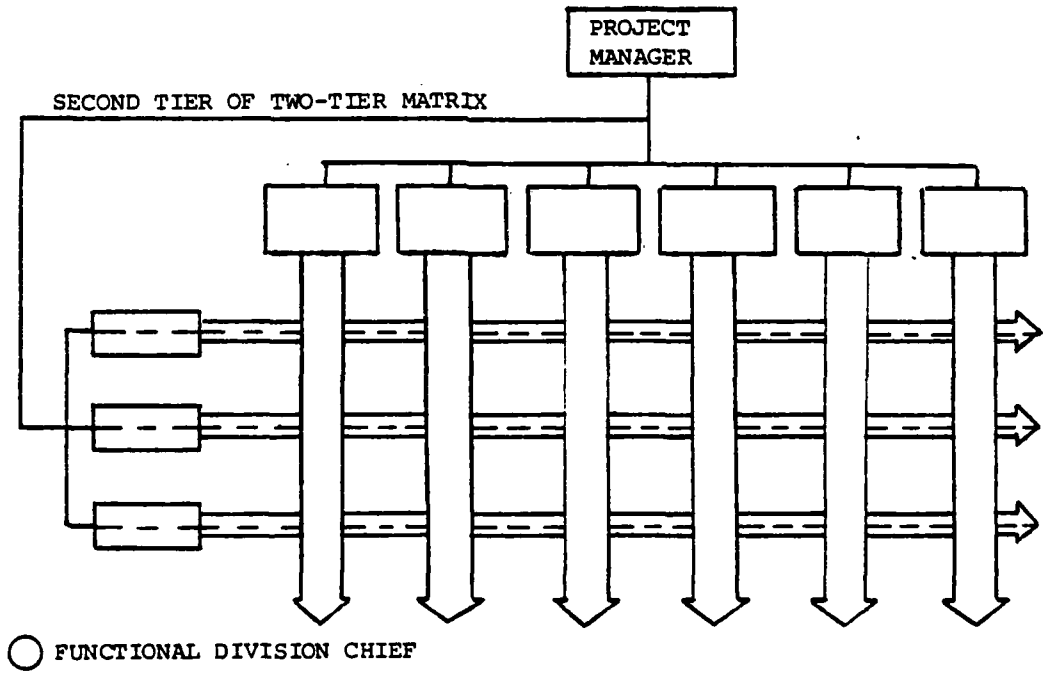


Fig. 3-4. The Separate Tiers of the Two-Tiered Matrix (16:41)

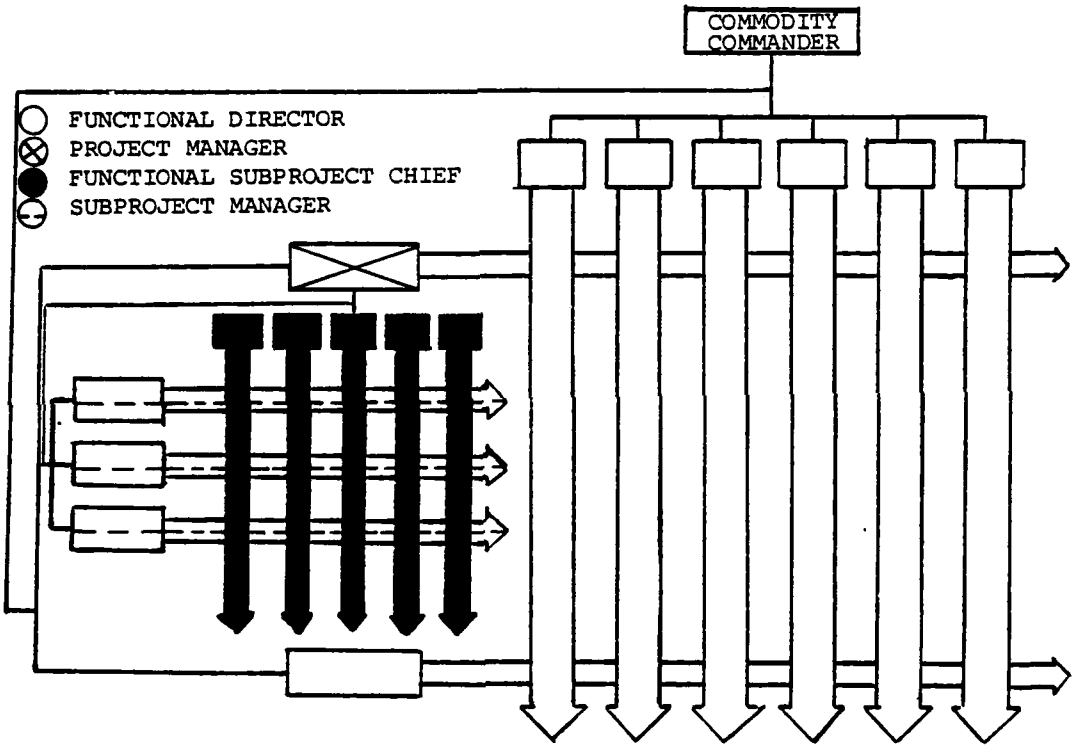


Fig. 3-5. The Complete Two-Tier Matrix (16-42)

with the addition of a geographical structure as the fourth dimension (see Figure 3-6). Davis and Lawrence have called such super-complex structures as "something of a limit" because they are "mind blowing to most managers and designers of organization charts [1:71]."

The mature matrix may be one of several variations of the three types already described. Whichever type of matrix is employed, it is used to derive some very real benefits.

> The major benefits of the matrix organization are the balancing of objectives, the coordination across functional department lines, and the visibility of the project objectives . . . [18:48].

Losi in paraphrasing Cleland and King summarized some matrix advantages as follows (7:8-9).

1. The project is emphasized by designating one individual as the focal point for all matters pertaining to it.
2. Utilization of manpower can be flexible because a reservoir of specialists is maintained in the functional organizations.
3. Specialized knowledge is available to all programs on an equal basis; knowledge and experience can be transferred from one project to another (corporate memory).
4. Project people have a functional home when they are no longer needed on a given project.
5. Responsiveness to project and customer needs is generally faster because lines of communication and decision points are centrally established.
6. Management consistency between projects can be maintained through the deliberate conflict operating in the project-functional environment.
7. A better balance between time, cost and performance can be obtained through the built-in checks and balances (the deliberate conflict) and the continuous negotiations carried on between the project and the functional organizations.

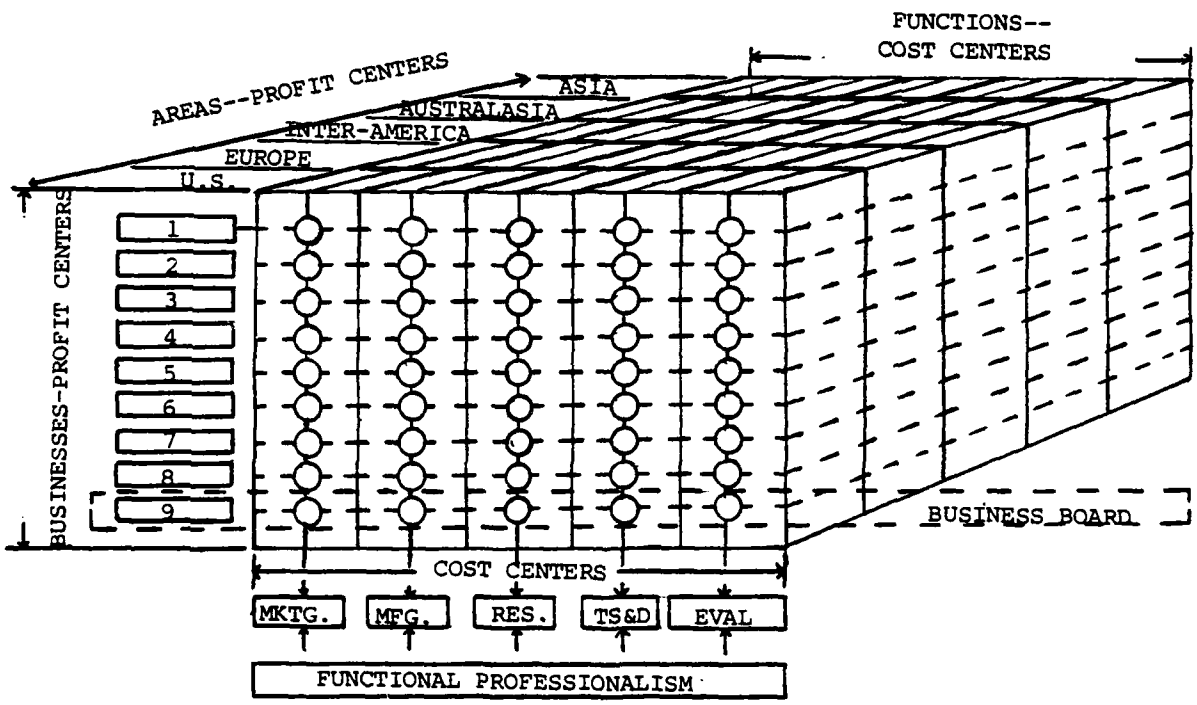


Fig. 3-6. Dow Corning--Multidimensional Structure (4:31)

8. Reduces duplication of effort and resources and thereby reduces cost of operation.

Drake has enumerated some additional advantages of the matrix structure which are noteworthy (3:20);

1. It is the least costly form of organization.

2. The Program Manager devotes time to the complex issues and coordination of the various program facets not to the details of execution.

3. It is probably the most efficient and productive organizational form.

4. Lessons learned can be selectively applied to other programs.

5. It provides for the sharing of critical skills.

6. It affords career broadening opportunities for functional specialists.

7. A strong degree of espirit de corps exists throughout the entire management team.

It has been proposed that three conditions must be met before adopting a formalized matrix structure would be advantageous to any organization. These have been termed as necessary and sufficient for matrixing (see Table 3-1).

Proponents argue that the advantages of the matrix design outweigh inherent disadvantages of matrixing. Davis

TABLE 3-1

MATRIX CONDITIONS (1:20)

Condition	Environmental Pressure	Behavioral Linkage
1:	Two or more critical sectors; functions, products, services, markets, areas	Balance of power, dual command, simultaneous decision making
2:	Performance of uncertain, complex and inter-dependent tasks	Enriched information-processing capacity
3:	Economies of scale	Shared and flexible use of scarce human resources

and Lawrence have in our opinion defined the ills of the matrix most clearly. Their findings are summarized below:

Tendencies toward anarchy. "A formless state of confusion where people do not recognize a 'boss' to whom they feel responsible [2:11]." In every matrix there are three critical roles: the top manager (who is not in the matrix), the matrix bosses (functional and project or area), and the manager who reports to two different matrix bosses. When the organization has not been explicit in defining the matrix relationship and reporting relationships, anarchy develops.

Power struggles. "Managers jockey for power in many organizations, but a matrix design almost encourages them to do so [2:13]." Healthy competition between the matrix bosses is advantageous to an organization. However,

power wars undermine the aim of the matrix. The top manager plays a crucial role in maintaining a balance of power between his subordinates.

Severe groupitis. "The mistaken belief that matrix management is the same as group decision making [2:14]." Confusion as to the basis of matrix management and its participative approach often leads to excessive group meetings with unnecessarily large quantities of disinterested personnel present. Clarification of matrix principles is vital in avoiding groupitis.

Collapse during economic crunch. "When business declines, the matrix becomes the scapegoat for poor management and is discarded [2:15]." A poorly planned and implemented structure together with bad management often spells the demise of the matrix, especially when an economic setback occurs. Had the matrix been properly constructed at the outset, the structure would have weathered the storm. "If a company's conditioned response to hard times is to retrench, it should not have attempted a matrix in the first place [2:16]."

Excessive overhead. "The fear of high costs associated with a matrix [2:16]." Initially, costs do rise in overhead. As the structure matures, productivity gains, fewer bad decisions, and less featherbedding offset the initial overhead gains. Management experience with the

matrix results in cutbacks in personnel and management slots when it is apparent that the matrix is overstaffed.

Sinking to lower levels.

> The matrix has some difficulty in staying alive at high levels of a corporation, and a corresponding tendency to sink to group and division levels where it thrives [2:17].

Two reasons lie behind sinking: (1) senior managers either have not understood the concept or have not been able to successfully implement it, or (2) the matrix has found a home at the lower level of the organization. Diverse corporations may not be able to implement matrix techniques corporation-wide because the concepts do not fit, but the matrix may suit one or more of the corporation's divisions. Successful implementation of matrix concepts at any level require the concerted efforts of top management.

Uncontrolled layering. "Matrices which lie within matrices which lie within matrices result frequently from the dynamics of power rather than from the logic of design [2:18]." Born of the urge to grab power, this type of matrixing is definitely unhealthy. If additional layering has been carefully planned and is necessary to the operation, power struggles taking this form will be minimal.

Navel gazing. "Managers in a matrix can succumb to excessive internal preoccupation and lose touch with the market place [2:19]." This symptom occurs at the outset

of the matrix implementation when people are figuring out how to make the matrix work. Once personnel are fully aware of the matrix relationships and comfortable with them, navel gazing disappears. During the period of introspection though, management must place emphasis on the organization's external relationships.

Decision strangulation. "Too much democracy, not enough action [2:19]!" This occurs when functional specialists are not entrusted to act for the functional department but have to clear decisions with functional managers. Another source of decision strangulation occurs when matrix bosses cannot agree on a decision and thus elevate the problem. And a third cause very often is the personal style of some managers, especially those who prefer to make unilateral decisions.

Although the advantages and disadvantages of the matrix form are many, the structure does operate well where it has been adequately pre-planned and conscientiously implemented. The purpose here has been to explain the basic matrix structure, its evolution, its variations, its advantages, and its disadvantages. For the purpose of our study, we are primarily concerned with the use of the simple matrix structure.

CHAPTER IV

EVALUATION CRITERIA

The evaluation of any organization, civilian or military, is a difficult task. What exactly is evaluation and what purpose is it intended to serve? Webster's New World Dictionary defines evaluate as a verb meaning "to find the value or amount of; or to judge the worth of." Evaluating the monetary worth of an organization is a considerably easier task than is judging the intangible worth of an organization. In the case of determining monetary worth, standard quantifiable measures have been constructed--assets, profit margins, invested capital, stock outstanding, et cetera. The intangibles of any organization--effectiveness, efficiency, morale, job satisfaction, and so forth cannot be measured in standard quantifiable terms. In either situation, the evaluator, judge, or researcher must use some tools with which to make an appraisal.

Criteria is defined as standards, rules, or tests by which something can be judged. At best, any criteria used to measure the intangibles of an organization will be only an approximation of the true situation and may be biased by the user's opinions.

In formulating criteria by which an Air Force organization could be evaluated for possible operational enhancement, we have attempted to achieve three primary goals. Foremost, we want to keep the criteria simple and understandable so that potential users can use these criteria to objectively evaluate their own organizations. Secondly, the criteria should be relatively inexpensive to employ. Finally, the criteria should be usable at all levels of the Air Force hierarchy to determine if adopting a formalized matrix or its techniques would aid the organization.

Our set of organizational evaluation criteria was derived from both library research and research examination of two base level Air Force units. With a set of preliminary criteria, drawn from the library research, we entered into personal interviews within the units. By examining the substructures of the units as individual entities and using the information garnered, we refined the criteria. Using the refined criteria, we re-interviewed personnel within the 2046th Communications and Installation Group to determine if our development goals had been achieved.

One of the most subjective elements about compiling criteria is categorization. Our criteria are split among four broad areas which we feel typify any organization. These general areas are the organization, the

personnel comprising the organization, the job to be performed, and the external environment of the organization. For the reader's ease of reference we have included a list of definitions and the evaluation criteria questions in Appendices A and B.

The Organization

One of the primary questions when looking at an organization must be: What is its mission or purpose? In other words, why is there an organization in the first place? The answer to this question can be either very specific or very broad. For example, an organization may be a repair facility for a particular type of antennas or, in a broader sense, the organization may repair all types of Air Force antennas.

To achieve its purpose an organization must have objectives which we define as hoped for results, goals, or targets. The objectives can be specific or general, such as an increase of 5 percent in Air Force enlistments or improved enlistee quality. What are the objectives of the organization?

Strategies are specific major actions or patterns of action for the attainment of desired objectives. These strategies should be well defined and congruent with the organization's objectives. Basically, the question is: What actions are required to reach the objectives?

The organizational structure can impede the implementation of strategies. If responsibility for making appropriate implementation decisions is at the wrong organizational level several things can occur. Three are, strategy implementation can be delayed, decisions can be made prematurely, and the decision itself could be wrong. Is the present organizational structure conducive to the implementation of the organization's strategies for achieving desired goals?

Resource utilization (money, materiel, and personnel) within an organization is a critical factor in its ability to achieve objectives. Can the organization's use of available resources be improved? Is there duplication of efforts and resources?

Is the organization project oriented? By this we mean that a large amount of the organization's work is directed toward the achievement of major projects. This could be the incremental rehabilitation of all base buildings or the development of a new electronic tracking aircraft. If the organization is project oriented, does that orientation pertain to the organization as a whole or to its substructures?

The Personnel

The cornerstone of any organization is its personnel. Without the human workforce, the means to

accomplish objectives would be missing. The character and morale of an organization's personnel play a vital role in organizational goal attainment.

The level of personal commitment to the mission and objectives of the organization can be either detrimental or advantageous. Are personnel committed toward achievement of the organization's mission and objectives? Do personnel perceive their part in the operation of the organization as meaningful?

The importance which personnel attach to clear definitions of duties and responsibilities can seriously impact an organization's operation. Some individuals work better when they know exactly what is expected of them, for example, while others function better in an uncertain environment. What types of personnel comprise the organization?

Personnel contentment with an organization is another important element to consider. When personnel are malcontent, there is a tendency for them to perform below capacity. Are they content with their present duties? If not, are they sufficiently motivated to suggest changes in any facet of the organization?

Perceptions about the level of managerial involvement and support often influence employees' attitudes about an organization. Do managers delegate responsibility or are they reluctant to do so? Does the workforce perceive

top management to be supportive of changes? These questions are important because individual involvement affects the individual's personal sense of satisfaction in the job. Additionally, if any individual is delegated the responsibility to accomplish a project, he must have confidence that his decisions will be supported by his superiors.

The Job

A multitude of different jobs or levels of work must be performed in the organization to reach overall objectives. The type of jobs involved in any operation can affect the organization's mission achievement and employee morale.

To maintain a steady work pace toward the goals of the organization, the jobs being performed should not be extraneous to those goals. For example, assigning Air Force recruiters to accomplish retention studies would be incongruent with their primary mission of recruiting personnel for the Air Force. Therefore, the evaluator should carefully scrutinize the organization to determine if the jobs being done are essential to mission accomplishment. Once essential jobs have been distinguished, the evaluator should ascertain if some of the work can be combined to better use resources.

A vital question to ask is whether personnel possess the necessary skills and knowledge with which to

perform the work. Is there an organization training program? If so, does it need improvement? The amount of employee expertise is another element of the job. An employee whose skills and knowledge are applicable to one particular job provides the manager less management flexibility than the individual whose expertise covers a wide spectrum of the organization's operations. Are the jobs specialized? Do they allow a degree of interchangeability among employees? For example, in the Air Force Standard Base Supply System individuals can be moved between sections without sacrificing job accomplishment. Changes among different squadrons such as maintenance and supply, due to the lack of task similarities, cannot be so freely made.

The nature of work being performed can either enhance or lower employee morale. A degree of individual creative freedom can make a distinctive impact on personnel morale. For example, if a job is repetitive in nature such as janitorial work, an employee soon loses incentive to improve his performance. If, however, an individual is allowed to rearrange his office, decide what his working hours will be (flex-time), or to draft and sign his own correspondence, he might well be motivated to make performance improvements. What is the nature of the jobs? Are they repetitive? Do they motivate the employee?

The Environment

The organization's environment is both internal and external and they are interdependent. The internal environment consists of such elements as the organization's structure, operations, and personnel, which we have addressed in the three previous categories. External environment refers to such elements as public opinion, governmental regulation, and labor unions, among others.

When considering an organization's external environment, it is necessary to address the stability of that environment. A stable environment is one which does not change rapidly. The dry cleaning business is considered to be in a stable environment. Rapid technological development is characteristic of a dynamic environment such as the aerospace industries. Is the organization in a dynamic or stable environment?

Governmental regulations (city, county, state, or federal) can impact an organization's operations. Pollution controls and safety standards, for example, are costly to implement and maintain. What are the effects of governmental regulations on operations?

Labor unions can be a deciding factor in an organization's mission accomplishment. The fewer unions that have interests in an organization's personnel, the easier it is for management to come to terms with union demands. Union size can determine its affect upon an organization.

The AFL-CIO can wield more leverage against an organization than can a small local union lacking the resources and support of the AFL-CIO. Are the organization's personnel strongly unionized?

In a dynamic environment an organization should be capable of reacting rapidly to changes. Structural constraints often inhibit that response. For example, the lengthy process by which computer systems are procured for the Air Force almost assures the user that his system will be technically obsolete before final delivery.

The questions we have posed are by no means all-inclusive. Depending upon the unit itself, a myriad of other questions may be raised. Many of the questions can only be answered subjectively but we feel we have created a framework useful for the evaluation of an organization and its subunits.

CHAPTER V

RESEARCH EVALUATION

Development of evaluation criteria for organizational needs assessment has been known to take experts years to refine to insure its validity for organizational use. One of the main reasons is the wide variety of organizations with multiple internal and external dependencies. Before discussing the results of our trial evaluation involving the 2046th CIG and the 2750th CES we shall define "organization" as we used it:

> Organization is the pattern of ways in which large numbers of people, too many to have intimate face-to-face contact with all others, and engaged in a comlexity of tasks, relate themselves to each other in the conscious, systematic establishment and accomplishment of mutually agreed purposes [11:30].

We have provided the definition at this time to show the reader that an organization does not necessarily mean the entire institutionalized group. When evaluating a situation for possible application of matrix management, the manager may choose to look at a portion of the organization. Such was the case when we tested our criteria at the CIG and CES units.

The 2046th CIG

During our interview with the 2046th CIG all questions of the evaluation criteria were covered. For the purpose of this portion of the study only a few issues will be addressed. These should provide the reader with a feeling for the questioning.

What is the mission/purpose of the organization? The mission of the 2046th CIG is to manage and execute Air Force responsibilities for communications-electronics-meteorological services in support of Air Force and other government agencies as directed by the Commander, Northern Communications Area. The mission statement and mission structure in Figure 5-1 shows the 2046th CIG to be very diverse. For evaluation criteria assessment, we chose to look at only the Installations Deputate (ID).

The ID is responsible for the performance of all duties pertaining to the installation of ground Communication-Electronics (C-E) equipment, fabrication of ground C-E equipment, on-site maintenance of fixed and mobile C-E equipment including modification, alignment, testing and technical order (T.O.) compliances, technical assistance, and emergency maintenance as directed by Headquarters Northern Communications Area (NCA). It provides advisory service to Air National Guard (ANG) Electronics Installation Squadrons. It provides initial installation training to all installers and scheduled follow-on training for

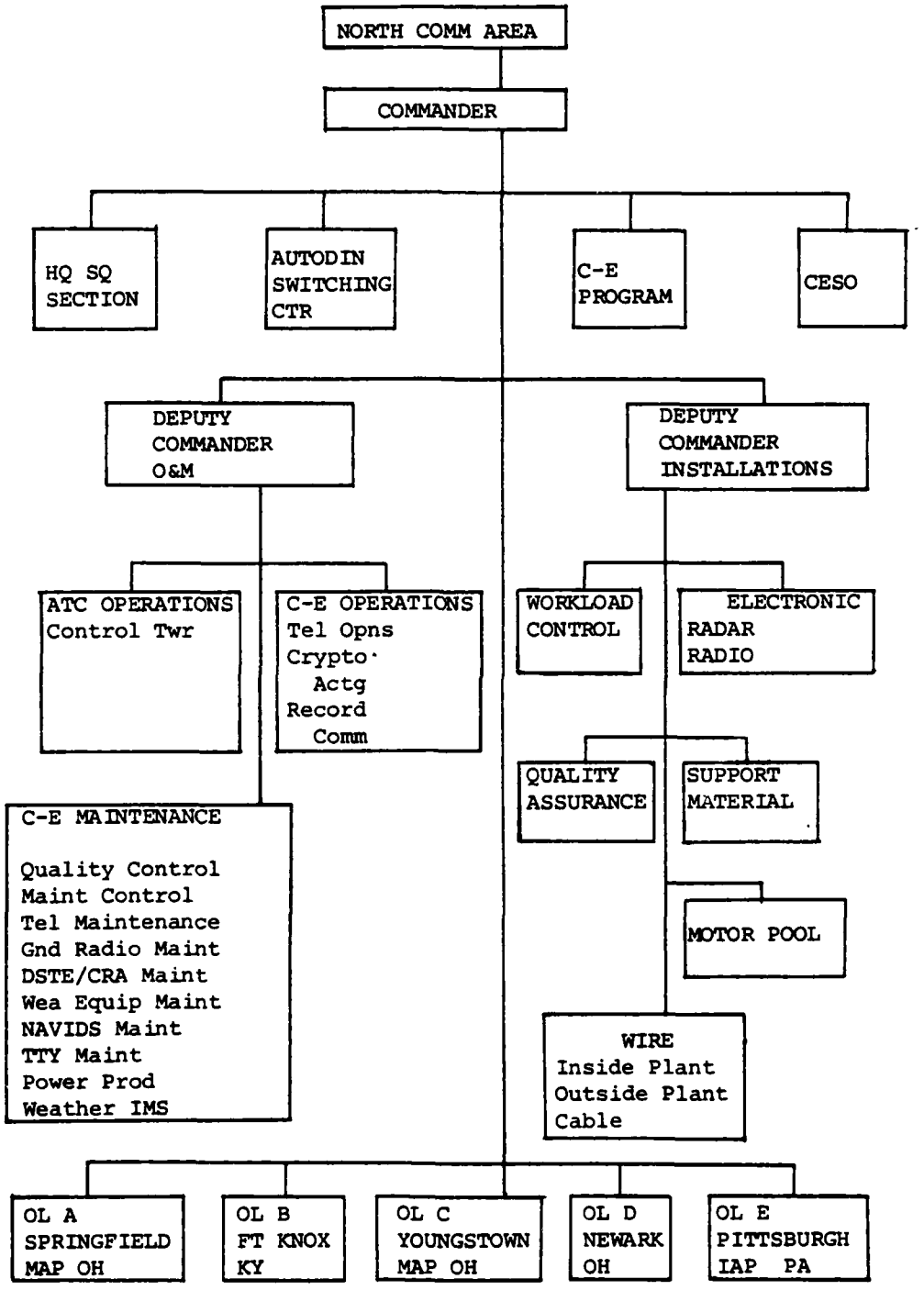


Fig. 5-1. 2046 Communications and Installation Group Organization

selected personnel to prepare them for team chief duties. The structure of the ID is shown as Figure 5-2.

Is effective use of resources being maintained? When the installers have completed a job and returned to the unit they have minimal duties. Most of these duties are military functions such as driver training, dental appointments, et cetera. This may indicate that resources could be realigned.

Is the organization project oriented? As can be seen by the mission statement of the organization, the unit is most definitely project oriented. These projects encompass the entire C-E spectrum from installation to modification.

Do personnel feel their position is meaningful? The managerial personnel we interviewed stated there is a true feeling of job satisfaction when the personnel are performing an installation job. When these individuals return to the unit, the large decrease in the use of their professional skills presents a morale issue.

Will top management support structure change? Reluctance to change is not uncommon to managers. At the ID it appears top management would support change provided the benefits for increased mission effectiveness override the drawbacks.

Are jobs specialized or do they allow a degree of interchangeability? The job descriptions of the

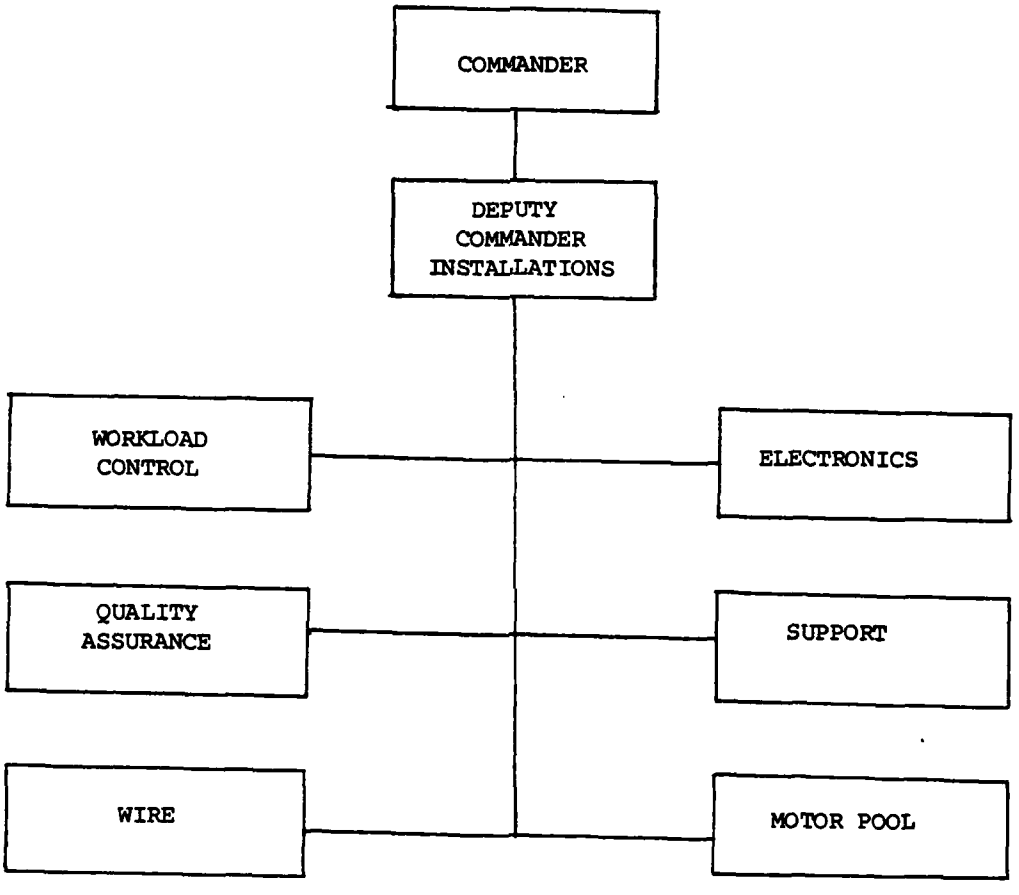


Fig. 5-2. Electronics Installation Deputate of the 2046 Communications and Installation Group Organization

electronics and the wire sections both state they are responsible for the installation and maintenance of ground C-E equipment which includes, but is not limited to, radio, radar, and NAVAIDS systems. Furthermore, they maintain the status of tools/AGE, and the equipment configuration. Also, they furnish requirements for tools, AGE, motor vehicles, and test equipment to the Support Division. These similarities would allow the efforts of the personnel to be combined. Any workers in these two sections could be deployed to perform an installation job whether it be wire or electronics oriented. One foreseeable problem would be insuring a properly skilled technician is available for the particular job.

Are local unions or job classifications major factors in structural change? Civilian job classifications could be a problem area. If training and maintenance were to be performed by the civilians while at their home unit, in many instances, their job descriptions would have to be rewritten. If additional job taskings were added, these could be considered as an increased weighting which may cause a paygrade change.

It was not our position to determine if the 2046th CIG ID should adopt a form of matrix, but rather to test our evaluation criteria. Personnel interviewed felt the criteria were relevant but, without a doubt,

interrelationships would require further examination prior to a structural change decision.

Because of the similarities of the skills of at least two sections of the ID, an overlapping of personnel is quite feasible. Matrixing would allow the installers to become more proficient in their entire career field by working with the operations personnel when at the home unit. A problem could be that an installer might be called upon for an off-site installation job thus not permitting him to complete a job he is presently working at his home unit.

The 2750th Operations and Maintenance (MEM)

Although the MEM did not apply formalized matrixing, it was interesting to note that even segments of a whole organization may find it worthwhile to use a form of matrix. Such was the case with the MEM planning section.

The MEM Branches are headed largely by civilians with many union workers making up a large portion of the manning. Without extensive review of union charters, a decision for change could not be made. This was beyond the scope of our study. However, we felt the MEM planning section's informal use of matrix techniques could be of value.

The planning section currently uses a simple form of matrix management. For planning purpose Wright-Patterson Air Force Base has been divided into three

geographical areas. Each area is assigned a permanent planning team, for area familiarization, consisting of eight men. The eight men comprising each team are civilians. There is one supervisor and the other seven form a body of tradesmen/specialists encompassing the various specialties of engineering. When a job request is received this group descends upon the job as a team, thus providing the combined expertise required to make the best judgements necessary for mission effectiveness. It is this grouping of individual specialties that represents a form of matrixing.

The importance of looking at the two organizations was to test the applicability of our evaluation criteria. This is a must. The final decision as to a need for change requires a thorough understanding of the present situation. We are the first to admit that the criteria are not all-inclusive, but we feel they are quite sufficient for making a structural decision as well as stimulating further questions relevant to the manager's particular situation. Even though a manager may be confident a change is required, there must be assurance that top management understands and will support the change.

CHAPTER VI

SUMMARY

Our efforts have been to provide the military manager with an understanding of a relatively new managerial concept: matrix management. Most experts believe the matrix concept is applicable solely to large scale organizations. While larger scale organizations in various fields have adopted successful formal matrix structures, smaller organizations have tended to retain either their functional or project forms. Matrixing is a difficult concept to employ, which may account for the lack of its use in smaller organizations.

To determine if an organizational structure can be formalized upon matrix lines requires each manager to review his own area as an individual entity. What is of significance for one organization to effectively meet mission requirements may not be significant to another. For this reason, it is necessary for each evaluator to critically evaluate his organization as best he can. If the evaluator determines that a change would not be conducive, his work is almost completed. On the other hand, if he has decided to formalize a particular matrix structure, his work has just begun. The evaluator must determine what the

change should achieve, which structure will be initiated, what changes are required, and what should be briefed to his superiors and subordinates. Once this change has been initiated, there must be continuous managerial support and follow-up to ensure control.

The 2750th Civil Engineering Squadron's Operations and Maintenance Branch successfully employs some matrix techniques although they are not specified in the organizational chart. One technique being used is the placement of civilian planners, each an expert in his respective field, on permanent area project teams. This has benefited the branch. Benefits realized by this informal matrix are that extensive delays in facility maintenance projects are not experienced, necessary paperwork is prepared by a knowledgeable individual, and coordination between the various professional elements such as electricians, plumbers, carpenters, and painters is at a maximum. These benefits have provided better work control and increased job satisfaction.

Discussions with the 2046th Communications and Installation Group, primarily the Chief, Installation Deputate, did not reveal any matrix techniques presently in-being. The deputate chief did feel, however, that some matrix concepts could be employed to solve some of his present problems. One of the problems he faces is better use of on-site personnel. Two of the deputate's sections

(electronics and wire) are very similar in task specification with only minor variations. This manager believes that the combination of the two sections would effect a cross-training resulting in a broader base of experience and greater interchangeability of the personnel for both on-site and off-site work. Further, a continuous workflow would be more evident and the morale of the personnel would be enhanced.

The Air Force is faced with greater challenges today than ever before. Fiscal constraints in the areas of civilian hiring coupled with enlistment shortfalls make it imperative that the military structure employ the best management practices to fully use its available resources. Matrix techniques are a sound option given that the military hierarchy is receptive to alteration of the traditional line and staff organization.

We are not suggesting that structural change to a matrix system is the solution to all problem areas. All managers are aware of the multitude of variables that require consideration in even the simplest decision. What we are advocating is that every manager has the responsibility of reviewing his area of concern on a frequent basis.

The evaluation criteria will serve as a manager's guide for organizational observation. The criteria will direct the manager to areas crucial to mission attainment and should further stimulate important thoughts about other

segments of his organizational review he feels are pertinent. Even if, after completing the review, the manager feels no adjustments are needed, he will have profited by an in-depth look at his organization's current situation.

APPENDICES

APPENDIX A

DEFINITIONS

Criteria--standards, rules, or tests by which something can be judged.

Functional organization--the grouping of work based on the similarities in natures and purposes of the work involved.

Job--levels of work.

Matrix management--an integrative management technique for sharing a common pool of specialists on a time-shared basis across the various product lines or projects.

Mission--the special task for organization being.

Objectives--hoped for results, goals, or targets.

Organization--the pattern of ways in which large numbers of people, too many to have intimate face-to-face contact with all others, and engaged in a complexity of tasks, relate themselves to each other in the conscious, systematic establishment and accomplishment of mutually agreed purposes.

Personal commitment--an individual's responsibility to his organization.

Project organization--the application of planning, organizing, coordinating, and controlling concepts and techniques to critical, complex, one of a kind jobs.

Resource utilization--the viable use of resources such as money, materiel, and personnel.

Strategies--specific major actions or patterns of actions for the attainment of desired objectives.

APPENDIX B

EVALUATION CRITERIA QUESTIONS

The Organization

1. What is its mission/purpose?

2. What are the objectives of the organization?

3. Are the objectives being attained?

4. Are strategies for objective attainment well defined?

5. Is structure compatible with strategies to meet desired goals?

6. Can the organization's uses of available resources (money, materiel, personnel) be improved?

7. Is there duplication of efforts and/or resources?

8. Is the organization project oriented?

9. If project oriented, does that orientation pertain to the organization as a whole or to its substructures?

The Personnel

1. Are personnel committed toward achievement of the organization's mission and objectives?

2. Do personnel perceive their part in the operation of the organization as meaningful?

3. Is importance attached to clear definitions of duties and responsibilities?

4. Are personnel content with their duties?

5. Are personnel sufficiently motivated to suggest changes in any facet of the organization?

6. Do managers delegate responsibility for a task?

7. Does the workforce perceive management to be supportive of changes?

The Job

1. Are existing jobs essential to organizational operations?
2. Does sufficient job expertise exist?
3. Can the training program be improved?
4. Are the jobs specialized?
5. Do the jobs allow a degree of interchangeability?
6. Do the jobs motivate the employees?

The Environment

1. Is the organization in a dynamic or stable environment?
2. Do governmental regulations (pollution controls, safety standards, etc.) impact operations?
3. Are the organization's personnel strongly unionized?
4. Do structural constraints inhibit an organization's response to change?

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